

THE GENUS ANTEOS HUBNER (LEPIDOPTERA, PIERIDAE).

Generic Status and Relationships, and Male Genitalia, with a Description of a New Structure in the Rhodocerini.

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As pointed out by Godman and Salvin (1) the New World species generally placed in the Old World genus *Gonepteryx* Leach are worthy of generic distinction. To these the generic name *Anteos* Hübner applies (2). Röber (3) along with other authors has advocated placing these species under *Amynthia* Swainson (4), but this name is of later date than *Anteos* and therefore a synonym. In spite of his own suggestion Röber places them in *Gonepteryx*.

Three very distinct species are known, *maerula* Fabricius, *clorinde* Godart and *menippe* Hübner. *Maerula* is the type of the genus, having been so designated by Godman and Salvin (1).

Menippe was tentatively placed in *Catopsilia* by Forbes (5) on the basis of the rounded secondaries and the rudimentary hair-pencil on the primaries. Although *menippe* does indeed differ from *maerula* and *clorinde* in various characters in which it more or less resembles *Catopsilia*, these characters seem insignificant compared with its striking similarity to *maerula* and *clorinde* in the male genitalia.

In making any comparison with *Catopsilia*, however, we must first define *Catopsilia*, inasmuch as structurally the Old World species of *Catopsilia* are exceedingly distinct from the New World species. This difference is so marked that the writer proposes to treat of it in a later paper. For the present purposes of comparison the Old World and the New World *Catopsilia* have been treated as distinct groups, with *C. florella* as representative of the Old World group and *C. statira* and *rurina* for the New World.

DESCRIPTION OF TERMS USED.

MALE GENITALIA.

Basal Prong of Uncus. (See Figs. 9 and 10.)—A small lobe located dorsally near base of uncus. Note that the presence of

this structure is correlated with the presence of the basal prong of the penis.

Harpe and its Lobes.—In *A. menippe* (Fig. 9) only one dorsal lobe is present, but in *A. maerula* and *clorinde* (Figs. 11 and 12) and in Old World *Catopsilia* (Fig. 10) two are present. The more basal I have designated "dorsal lobe *a*." Dorsal lobe *a* is evidently a thickened portion of the infolded edge of the harpe, and bears strong setae distally. Dorsal lobe *b* is in *Anteos* and Old World *Catopsilia* a more or less trough shaped structure, heavily chitinized along its distal edge. In *Gonepteryx* (Fig. 2) it is merely a pointed heavily chitinized lobe, while in New World *Catopsilia* it shows high development (Figs. 1 and 4).

The distal process is comparatively simple in all the groups except New World *Catopsilia* where it often shows some evidence of bifurcation and bears heavily chitinized teeth (Fig. 1).

Ventral lobe *a* arises, as does dorsal lobe *a*, from the infolding of the edge of the harpe, is rounded and bears strong setae. It is absent in the New World *Catopsilia* (except *statira* where it is exceedingly weak) and in *Gonepteryx*. It is small, fairly heavily chitinized, and probably arises from the distal process as was postulated by the writer for an homologous lobe in New World *Eurema* (6).

Penis. The basal prong of the penis appears to be present always when the basal prong of the uncus is present. The variously heavily chitinized teeth on the penis are relatively constant in presence and position. In *Anteos* they furnish characters for differentiation of the species. (See Figs. 9, 11, 12.)

THE RAISED LINE (See Figs. 3, 5-8).

This curious structure, if I may call it a structure, has not, as far as can be determined, hitherto been noticed or used in classification. It consists of a narrow line on the primaries above, formed by a double or triple row of scales which are raised up more or less on end. Needless to say it is rather hard to see and does not show on rubbed specimens nor on those in which the wings have been pressed down hard by glass on the mounting board. It is best seen by examining the wing with a strong light striking it at a very acute angle.

I should hesitate to make use of so minute and evanescent a character were it not for the fact that examination of a large series of specimens has shown it to be constant in position and to

correlate well with structural characters of undoubted value. It has been noted on species of all the groups of *Eurymus* (*Colias*) and *Meganostoma*, on *Teriocolias*, *Dercas* and *Eurema*, on *Gonepteryx*, *Anteos*, *Nathalis*, *Kricogonia*, and on both New and Old World *Catopsilia*. In all of these its position is definite. In some cases specific differences are shown, in other cases generic differences. The structure seems to be limited to the *Rhodocerini*.

The origin of the raised line is hard to state, especially at this early date. A guess, which may prove to be correct, is that it is caused by the silk band or thread around the pupa.

The line is most easily seen in *Gonepteryx* where it appears to point out a specific difference between *rhamni* and *cleopatra*.

COMPARISON OF ANTEOS WITH CATOPSILIA AND GONEPTERYX.

As the data do not readily lend themselves to a tabular arrangement the groups under consideration are compared structure by structure as follows:

Apex of Primary:

Anteos—

a. *menippe*—rounded, slightly falcate.

b. *maerula* and *clorinde*—bluntly pointed, strongly falcate.

Old World Catopsilia—rounded, not falcate or very slightly so.

New World Catopsilia—

a. *avellanada*—rounded, slightly falcate.

b. other species—rounded, not falcate.

Gonepteryx—acute, slightly to strongly falcate.

Outer Margin of Secondary:

Anteos—

a. *menippe*—rounded, slightly scalloped between veins.

b. *maerula* and *clorinde*—acutely tailed at M_3 (cf. *Gonepteryx*).

Old World Catopsilia—rounded, slightly scalloped between veins.

New World Catopsilia—

a. majority of species—rounded, slightly scalloped between veins.

b. *neocipris*—a rounded tail at 2d A.

Gonepteryx—acutely tailed at Cu_1 .

Venation of Primary:

Anteos—

a. *menippe*— M_1 stalked on $R_3 + R_{4+5}$ very slightly more than half way out from cell to base of R_{4+5} ; distance from

base of R_2 to end of cell very slightly greater than length of middle discocellular.

- b. *maerula* and *clorinde*— M_1 stalked on $R_3 + R_{4+5}$ considerably more than half way out from cell to base of R_{4+5} ; distance from R_2 to end of cell very slightly less than length of middle discocellular.

Old World Catopsilia— M_1 stalked on $R_3 + R_{4+5}$ about half way out from cell to base of R_{4+5} ; distance from R_2 to end of cell less than length of middle discocellular.

New World Catopsilia— M_1 stalked on $R_3 + R_{4+5}$ from $1/3$ to $1/2$ way out from cell to base of R_{4+5} ; distance from R_2 to end of cell averaging equal to length of middle discocellular.

Gonepteryx— M_1 stalked on $R_3 + R_{4+5}$ from $1/3$ to slightly less than $1/2$ way out from cell to base of R_{4+5} ; distance from R_2 to end of cell from 2 to 3 times the length of the middle discocellular.

Scent Patches and Hair Pencils on Males:

Anteos—present in all species.

Old World Catopsilia—present in all species.

New World Catopsilia—absent in a number of species.

Gonepteryx—absent.

Raised Line:

Anteos—indistinct, running from inner margin into cell at or slightly above base of Cu_2 .

Old World Catopsilia—indistinct, running from inner margin into cell at or slightly above base of Cu_2 .

New World Catopsilia—

- a. majority of species—runs from inner margin distad of cell, cutting M_3 distad of cell.
b. *agarithe* and *trite*—runs from inner margin into cell about base of Cu_1 .

Gonepteryx—very distinct, running from inner margin distad of cell, cutting M_3 distad of the cell a distance equal to the length of the lower discocellular in *rhamnii* and twice the length of the lower discocellular in *cleopatra*.

Harpe:

Anteos—wider than long.

Old World Catopsilia—wider than long.

New World Catopsilia—longer than wide.

Gonepteryx—longer than wide.

Dorsal Lobe a of Harpe:

Anteos—

- a. *menippe*—absent or very weak.

b. *maerula* and *clorinde*—present, fairly strong, rounded, setiferous.

Old World Catopsilia—present, strong, rounded, setiferous.

New World Catopsilia—usually absent, very weak if present.

Gonepteryx—absent.

Dorsal Lobe b of Harpe:

Anteos—present.

Old World Catopsilia—present.

New World Catopsilia—present, very highly developed.

Gonepteryx—present, very simple.

Ventral Lobe a of Harpe:

Anteos—present, well developed, rounded, setiferous.

Old World Catopsilia—present, well developed, rounded, setiferous.

New World Catopsilia—very weak, seldom present.

Gonepteryx—absent.

Ventral Lobe b of Harpe:

Anteos—absent.

Old World Catopsilia—absent.

New World Catopsilia—absent.

Gonepteryx—present, small.

Basal Prong of Uncus:

Anteos—present.

Old World Catopsilia—present.

New World Catopsilia—absent.

Gonepteryx—absent.

Basal Prong of Penis:

Anteos—present.

Old World Catopsilia—present.

New World Catopsilia—absent.

Gonepteryx—absent.

Chitinous Teeth on Penis:

Anteos—present.

Old World Catopsilia—present, sometimes reduced.

New World Catopsilia—absent.

Gonepteryx—absent.

Saccus:

Anteos—short, thick, less than half the length of the vinculum.

Old World Catopsilia—short, thick, less than half the length of the vinculum.

New World Catopsilia—long, slender, more than $\frac{3}{4}$ the length of the vinculum.

Gonepteryx—long, slender, more than $3/4$ the length of the vinculum.

Distal Process of Harpe:

Anteos—short, curved (rounded in *maerula*).

Old World Catopsilia—short, rounded.

New World Catopsilia—long, strongly developed.

Gonepteryx—long, curved.

SUMMARY AND CONCLUSIONS.

A study of the foregoing data shows that *Anteos* is undoubtedly closely related to the Old World species of *Catopsilia*, while in almost every character it shows strong differences from *Gonepteryx*. Leaving aside the relationships of *Catopsilia*, which will be covered in a later paper, the writer postulates the following conclusions:

(1) *Anteos* Hübner is generically exceedingly distinct from *Gonepteryx* Leach.

(2) *Anteos* is closely related to the Old World species of *Catopsilia* and more distantly related to the New World species of *Catopsilia*.

(3) The species *menippe* Hübner should be placed in *Anteos*, where it forms a connecting link between the other two species and Old World *Catopsilia*.

GENERIC CHARACTERS, ANTEOS HÜBNER.

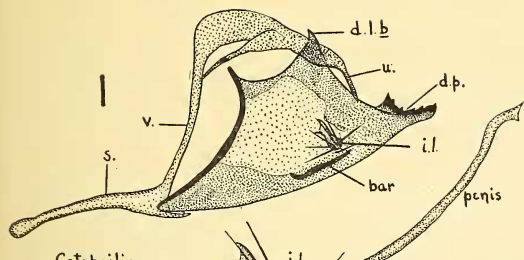
Size very large, averaging from 80-90 mm. Primaries above with a large brownish black discocellular dot. Males with a hair pencil on base of inner margin of primaries and a patch of scent scales on base of secondaries above Rs. Apex of primaries rounded, more or less falcate. R_4 and R_5 anastomosed, stalked with R_3 . M_1 stalked on $R_3 + R_{4+5}$ more than half way from cell to base of R_{4+5} . Middle discocellular of both wings at least two-thirds as long as lower discocellular. Raised line on primaries above running from inner margin into cell at or slightly above base of Cu_2 . Uncus with a basal prong. Saccus short, thick, less than half the length of the vinculum. Harpe short and wide with a short distal process, at least one dorsal lobe which is strongly chitinized along one edge, and a short rounded ventral lobe which bears strong setae. Penis with a strong basal prong and two or more strongly chitinized teeth distally.

KEY TO SPECIES, MALES. (*Superficial characters.*)

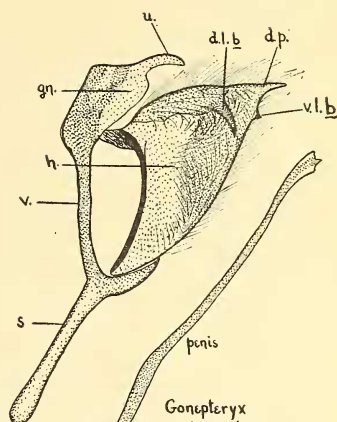
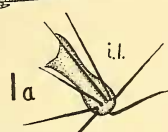
1. Primaries above with a narrow black apical border and an apical orange patch; apex of primaries not strongly falcate; secondaries not strongly tailed at M_1 ; scent patch extending from R_s to $Sc + R_1$ basally and apically along R_s past end of cell, brownish; inner margin of primary strongly bowed down at about middle; costa of primary lightly serrate. *menippe* Hübner.
 Primaries above with no apical markings; apex of primaries strongly falcate; secondaries strongly tailed at M_1 ; scent patch whitish or not reaching $Sc + R_1$; inner margin of primary slightly bowed downward; costa of primary strongly serrate. 2
2. Wings above yellow, no discocellular dot on secondaries above; scent patch large, extending basally from R_s to $Sc + R_1$ and distally along R_s beyond cell, whitish. *maerula* Fabricius.
 Wings above white with a transverse yellow-orange patch extending from costa of primaries across end of cell, and a brownish black discocellular dot on secondaries surrounded by a deep orange spot; scent patch small, not reaching half way from R_s to $Sc + R_1$, brownish *clorinde* Godart.

KEY TO SPECIES, MALES. (*Structural characters.*)

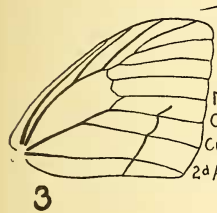
1. Distal process of harpe long and pointed; dorsal lobe *a* absent; dorsal lobe *b* longer than basal prong of penis; basal prong of penis short and rounded at the tip with no areas of heavier chitinization; penis with two large heavily chitinized teeth at tip. *menippe*
 Distal process of harpe shorter, rounded or pointed; dorsal lobe *a* present; dorsal lobe *b* shorter than basal prong of penis; basal prong of penis long, with the tip either pointed or with a more heavily chitinized cap; penis with a number of small heavily chitinized teeth on distal half. 2
2. Distal process of harpe pointed; both dorsal lobe *a* and ventral lobe narrow, well differentiated from infolding of edge of harpe; penis with a more heavily chitinized cap on both tip of basal prong of penis and of penis itself; teeth on penis small, limited to distal quarter. *clorinde*
 Distal process of harpe blunt; both dorsal lobe *a* and ventral lobe hardly differentiated from infolding of edge of harpe except by setiferous area; basal prong of penis and penis itself with no more heavily chitinized cap on tip; teeth on penis larger, not limited to distal third *maerula*



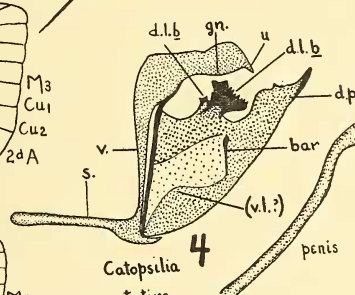
Catopsilia rurina



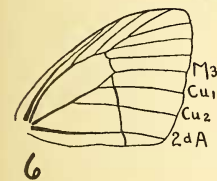
Gonopteryx rhamni



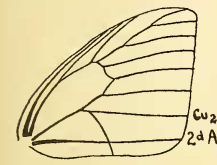
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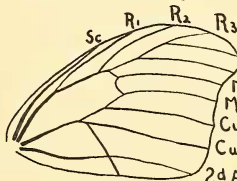
Catopsilia statira



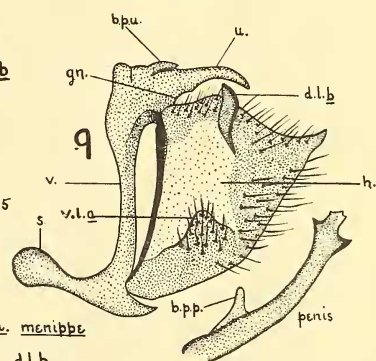
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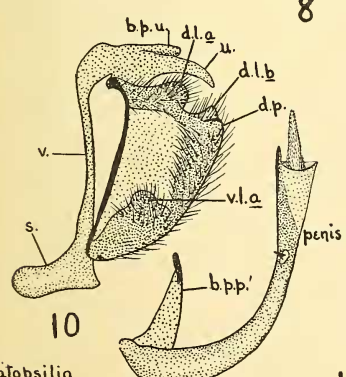
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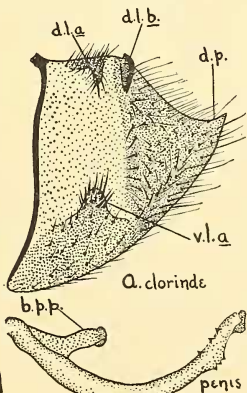


A. menippe



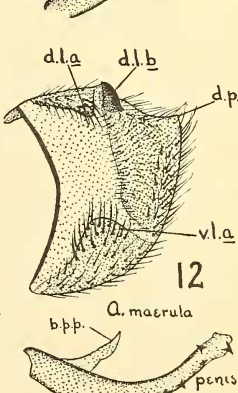
Catopsilia florilla

10



A. clorinde

11



A. macrula

12

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 (6) Klots, Journ. N. Y. Ent. Soc. XXXVI, 61, March, 1928.

EXPLANATION OF FIGURES.

- Fig. 1. Lateral aspect ♂ genitalia *Catopsilia rurina* Felder, left harpe removed showing ental aspect of right harpe.
 Fig. 1a. Enlarged drawing of *inner lobe* of above.
 Fig. 2. Lateral aspect ♂ genitalia *Gonepteryx rhamni* L., left harpe removed showing ental aspect of right harpe.
 Fig. 3. Venation of primary, *Catopsilia philea* L., showing position of *raised line*.
 Fig. 4. Lateral aspect ♂ genitalia *Catopsilia statira* Cramer, left harpe removed showing ental aspect of right harpe.
 Fig. 4a. Enlarged drawing of *dorsal lobe b* of above.
 Fig. 5. Venation of primary, *Gonepteryx rhamni* L., showing position of *raised line*.
 Fig. 6. Venation of primary, *Catopsilia argante* Fabricius, showing position of *raised line*.
 Fig. 7. Venation of primary, *Catopsilia florella* Fabricius, showing position of *raised line*.
 Fig. 8. Venation of primary, *Anteos clorinde* Godart, showing position of *raised line*.
 Fig. 9. Lateral aspect ♂ genitalia *Anteos menippe* Hübner, left harpe removed showing ental aspect of right harpe.
 Fig. 10. Lateral aspect ♂ genitalia *Catopsilia florella* Fabricius, left harpe removed showing ental aspect of right harpe.
 Fig. 11. Ental aspect of right harpe and lateral aspect of penis, *Anteos clorinde*.
 Fig. 12. Ental aspect of right harpe and lateral aspect of penis, *Anteos maerula* Fabricius.

LIST OF SYMBOLS.

- | | | | |
|--------|----------------------------|--------|-----------------------------------|
| bar | = chitinized bar of harpe. | h. | = harpe. |
| b.p.p. | = basal prong of penis. | i.l. | = inner lobe. |
| b.p.u. | = basal prong of uncus. | s. | = saccus. |
| d.l.a. | = dorsal lobe <i>a</i> . | u. | = uncus. |
| d.l.b. | = dorsal lobe <i>b</i> . | v. | = vinculum. |
| d.p. | = distal process of harpe. | v.l.a. | = ventral lobe <i>a</i> of harpe. |
| gn. | = gnathos. | v.l.b. | = ventral lobe <i>b</i> of harpe. |